Appendix

Methodology Used to Project Numbers of Lead Poisoned Children and Trends in the American Housing Stock, 2000-2010

Eliminating Childhood Lead Poisoning:

A Federal Strategy Targeting Lead Paint Hazards

President's Task Force on Environmental Health Risks and Safety Risks to Children

ELIMINATING CHILDHOOD LEAD POISONING:
A FEDERAL STRATEGY TARGETING LEAD PAINT HAZARDS

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February, 2000

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President's Task Force on
Environmental Health Risks and Safety Risks to Children

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Appendix

Methodology Used to Project Numbers of Lead Poisoned Children and Trends in the American Housing Stock, 2000-2010

This document explains how the number of children under age 6 with lead poisoning can be projected for future years. The projections, before and after Federal intervention, combine data from the following sources:

- The Third National Health And Nutrition Examination Survey (NHANES III) Phase 2
- The American Housing Survey
- The Residential Energy Consumption Survey
- The HUD National Lead Paint Survey

The lead poisoning projections show that ongoing demolition and rehabilitation of older housing units, which account for most of the lead paint in housing, should result in a steady decline in the number of lead poisoned children over the next decade. In the absence of Federal intervention, however, this analysis estimates that there would still be 185,000 lead poisoned children under age six living in pre-1975 housing in the year 2010, in households with a poverty income ratio (PIR) of less than 1.3. (PIR is equal to household income divided by the poverty income level, so households with PIR below 1.3 are under 130 percent of the official poverty level).

The methodology used to project the number of lead poisoned children, and the benefits of Federal intervention, are explained below in eight sections:

1. NHANES III Phase 2 data and limitations.
2. Combining American Housing Survey and NHANES data to estimate the number of lead poisoned children in 1993 and 1997.
3. Using American Housing Survey, Residential Energy Consumption Survey, and HUD National Lead Paint Survey data to forecast number of housing units with “high” and “low” risk of lead paint hazards.
4. Calculating the prevalence of children with lead poisoning for high and low risk housing.
5. Forecasting lead poisoning prevalence by PIR and age of housing based on the percentage of the housing stock with a high risk of lead paint hazards.
6. Projecting the number of lead poisoned children in low and high risk units, before and after adjustment for the HUD rule for Federally assisted housing.
7. Adjusting projections for lead poisoned children to reflect the impact of an expanded HUD Lead Hazard Control Grant Program.
8. Estimating the benefits and net benefits of an expanded Lead Hazard Control Grant Program.

In this document, the term "lead poisoned children" refers to children with blood lead levels above 10 µg/dL. CDC guidelines have established this level as a threshold for public health response and one at which the evidence for harm to children's health is well established. However, considerable evidence also links blood lead levels below 10 µg/dL in young children to cognitive losses (lower IQ) that reduce the average lifetime earnings of such children. Lead paint hazard control activities provide the greatest benefit to children who avoid lead poisoning, but these same activities also benefit other children by reducing the average blood lead for children below 10 µg/dL. The Economic Analysis for the HUD Lead Paint Regulation for Federally Assisted Housing estimates the combined monetized health benefit per housing unit where lead hazards are controlled. This "unit benefit" includes the benefit to children who avoid lead poisoning, plus the benefit of lower blood lead levels for other children (below 10 µg/dL). Although the first seven sections of this document focus on the projected number of the lead poisoned children, the analysis of benefits in Section 8 includes the total benefit of lead hazard reduction, including the benefit of lower blood lead levels for children below 10 µg/dL.

1. NHANES III Phase 2 Data and Limitations

Tables 1 and 2 show NHANES III Phase 2 data on the prevalence of children under age 6 with blood lead levels above 10 and 15 µg/dL, within year of home construction, poverty income ratio (PIR), and Metropolitan Statistical Area (MSA) population categories. The "don't know" category refers to NHANES respondents who didn't know the age of their housing unit. People in older housing units may be less likely to know the age of their unit, which suggests that most of the "don't know" units are older units. This would also explain why the prevalence of children with lead poisoning in the "don't know" category is similar to the prevalence in older units.

NHANES III Phase 2 reported the prevalence of children above 10 µg/dL by age of housing, MSA population, and three PIR categories. These data were recreated for Table 1 to ensure that this analysis reflects the same population weights and statistical methods reflected in the NHANES data reported in Morbidity and Mortality Weekly Report (February 21, 1997). For the remainder of this analysis, however, only two PIR categories were used - above and below 1.3 (families above and below 130% of the poverty income level, where poverty income is adjusted for family size and inflation but not for geographic variations in income). This was done because the small amount of NHANES sample data for higher income children was inadequate to support projections with any reasonable degree of confidence.

Tables 1 and 2 both indicate that lower income children and children in older housing are more likely to be lead poisoned. Table 1 shows a surprisingly high prevalence of low-income children in post-73 housing with blood lead > 10 µg/dL, but Table 2 shows that almost none of these low-income children in post-73 housing have blood lead > 15 µg/dL. In fact, the prevalence of children above 15 µg/dL is also extremely low in 1946-73 housing. The prevalence of children with blood lead levels above 15 µg/dL is especially high for children with PIR less than 1.3, in pre-46 housing in MSAs with population greater than one million.

Table 1. Prevalence of Children Under Age 6 With Blood Lead Levels ≥10 µg/dL, by PIR, MSA Size, and Year House Built (% of children within each cell)

	Year House Built:			
	Pre-1946	1946-1973	Post-1973	Don't know
Characteristic	%	%	%	%
PIR ≤ 1.3 (low)	16.37	7.25	4.33	6.02
1.3 < PIR ≤ 3.5 (Medium)	4.09	2.01	0.38	2.95
3.5 < PIR < 8.5 (High)	0.87	2.65	0	0
PIR > 1.3	3.19	2.24	.22	2.81
MSA population< 1 million	5.77	3.06	2.51	2.17
MSA population ≥ 1 million	11.49	5.80	0.81	7.89
PIR ≤ 1.3 and MSA pop < 1 million	10.62	3.82	6.48	2.92
PIR ≤ 1.3 and MSA pop ≥ 1 million	22.27	9.09	2.65	8.39
PIR >1.3 and MSA pop < 1 million	3.03	2.38	0.22	0.52
PIR >1.3 and MSA pop ≥ 1 million	3.35	2.10	0.21	4.22

Source: Third National Health and Nutrition Examination Survey—Phase 2, 1991-1994 (MMWR, February 21, 1997).

Table 2. Prevalence of Children Under Age 6 With Blood Lead Levels ≥ 15 µg/dL, by PIR, MSA Size, and Year House Built (% of children within each cell)

	Year House Built:			
	Pre-1946	1946-1973	Post-1973	Don't know
Characteristic	%	%	%	%
PIR ≤ 1.3 (low)	6.75	1.19	0.12	3.60
1.3 < PIR ≤ 3.5 (Medium)	1.77	0.16	0.38	0.21
3.5 < PIR ≤ 8.5 (High)	0	0	0	0
PIR > 1.3	1.27	0.10	0.22	0.20
MSA population < 1 million	1.44	0.63	0.67	0.13
MSA population ≥ 1 million	5.71	0.70	0.21	4.66
PIR ≤ 1.3 and MSA pop < 1 million	1.35	1.30	0	0
PIR ≤ 1.3 and MSA pop ≥ 1 million	12.30	1.13	0.21	6.35
PIR >1.3 and MSA pop < 1 million	1.67	0	0.22	0.52
PIR >1.3 and MSA pop ≥ 1 million	0.88	0.20	0.21	0

Source: Third National Health and Nutrition Examination Survey—Phase 2, 1991-1994

Table 3 shows the sample size limitations of the NHANES data, which could distort the projected number of lead poisoned children in post-73 housing. The total NHANES sample of children under 6 with blood lead, MSA, and PIR data is 2214, but only 13 children living in post-73 housing were above 10 µg/dL and only three were above 15 µg/dL. The limitations of the NHANES sample result in large 95% confidence intervals around the prevalence estimates in Tables 1 and 2. For example, the prevalence estimate of 16.37% for children with PIR less than 1.3 in pre-46 housing has a 95% confidence interval of 9.9% to 27.2%. For children with PIR less than 1.3 in post-73 housing, the prevalence estimate of 4.33% has a 95% confidence interval of 2.1% to 9.1%.

The small prevalence of lead poisoned children in post-73 housing multiplied by the large number of children in post-73 housing still results in a significant number of lead poisoned children. With the growth in post-73 housing between 1993 and 1997, the estimated number of lead poisoned children in post-73 housing will grow accordingly. This estimate would be reasonable only if the lead poisoning prevalence for children in post-73 housing were entirely due to lead hazards unrelated to housing (and if no progress in reducing such hazards were anticipated). However, American Housing Survey data indicate that over one-third of all families with children under 6 in 1993 moved into their then current residence within the previous two years, and almost half moved within the previous three years. Therefore, it is likely that many lead poisoned children in post-73 housing were exposed to lead paint hazards at an older previous residence. Others may have been exposed at a friend or relative's residence, and still others may have been exposed to lead paint hazards from older buildings in their immediate neighborhood. For all of these reasons, a reduction in older units with lead paint hazards is also likely to reduce the lead poisoning prevalence for children in post-73 housing.

2. Combining American Housing Survey and NHANES Data to Estimate the Number of Lead Poisoned Children in 1993 and 1997

Table 4 shows the total number of children under 6 by year of home construction, PIR, and MSA size, based on 1993 American Housing Survey data. Table 5 combines the NHANES data from Table 1 with the American Housing Survey data from Table 4 to estimate the number of children under 6 with blood lead levels above 10 µg/dL in 1993. American Housing Survey data are reported in slightly different time intervals than NHANES data, so pre-40 housing is associated with pre-46 prevalence estimates (most housing built in the 1940s was built after 1945) and post-74 housing is associated with post-73 prevalence estimates. Each cell or household category in Table 5 reflects the prevalence of children under 6 with blood lead levels above 10 µg/dL for that housing category in Table 1 multiplied by the total number of children under 6 in that household category from Table 4. (The NHANES data relating to the "don't know" age of housing category were not used in this analysis). These calculations yield estimates of 887,000 to 993,000 for the total number of children above 10 µg/dL, versus 930,000 reported by MMWR (based on population census weights). (MMWR revised this estimate to 890,000 in an erratum published July 4, 1997). Table 6 applies the same approach to combine NHANES data in Table 2 with American Housing Survey data in Table 4 to estimate the number of children under 6 with blood lead levels above 15 µg/dL in 1993. Of particular interest in Table 6 is the fact that children under 6 with PIR less than 1.3, in pre-46 housing, and in MSAs with population greater than one million account for more than half of all children under 6 with blood lead levels above 15 µg/dL.

Table 3. NHANES Phase 2 Blood Lead Data for Children Under Age 6 (raw numbers)

	Year House Built:												
	Pre- 1946			**1946-1973**			**Post 1973**			**Don't Know**			**Total**
	Total	**≥ 10**	**≥ 15**	*Total*	**≥ 10**	**≥ 15**	*Total*	**≥ 10**	**≥ 15**	*Total*	**≥ 10**	**≥ 15**	
Children with PIR < 1.3	192	35	13	511	45	10	294	11	1	230	17	10	1227
Children with PIR > 1.3	147	9	5	341	10	1	412	2	2	87	4	1	987
Total	*339*	*44*	*18*	*852*	*55*	*11*	*706*	*13*	*3*	*317*	*21*	*11*	***2214***
Children in MSA < 1 million	159	14	4	339	16	5	388	9	2	145	4	1	1031
Children in MSA ≥ 1 million	209	35	16	550	41	7	356	6	2	206	21	12	1321
Total	*368*	*49*	*20*	*889*	*57*	*11*	*744*	*15*	*4*	*351*	*25*	*13*	***2352***
PIR ≤ 1.3 & MSA < 1 million	74	10	2	179	9	4	152	6	0	94	3	0	499
PIR ≤ 1.3 & MSA ≥ 1 million	118	25	11	332	36	6	142	5	1	136	14	10	728
PIR >1.3 & MSA < 1 million	73	3	2	145	5	0	221	1	1	37	1	1	476
PIR >1.3 & MSA ≥ 1 million	74	6	3	196	5	1	191	1	1	50	3	0	511
Total	*339*	*44*	*18*	*852*	*55*	*11*	*706*	*13*	*3*	*317*	*21*	*11*	***2214***

Source: U.S., Third National Health and Nutrition Examination Survey—Phase 2, 1992-1994

Table 4. 1993 Number of Children (in millions) Under Age 6 by PIR and MSA

	Year House Built:		
	Pre-1940	**1940-1974**	**Post 1974**
Children with PIR ≤ 1.3	1.98	3.53	1.89
Children with PIR > 1.3	2.75	6.18	6.50
Total	*4.73*	*9.71*	*8.39*
Children in MSA population area < 1 million	2.60	4.76	5.68
Children in MSA population area > 1 million	2.13	4.95	2.71
Total	*4.73*	*9.71*	*8.39*
Children with PIR ≤ 1.3, MSA pop < 1million	1.02	1.83	1.33
Children with PIR ≤ 1.3, MSA pop > 1 million	0.96	1.7	0.56
Children with PIR > 1.3, MSA pop < 1 million	1.58	2.94	4.34
Children with PIR > 1.3, MSA pop > 1 million	1.17	3.24	2.16
Total	*4.73*	*9.71*	*8.39*

Source: U.S. Bureau of the Census and U.S. Department of Housing and Urban Development, "American Housing Survey for the United States in 1993."

Table 5: 1993 Number of Children (in thousands) Under Age 6 With Blood Lead Levels ≥10 µg/dL, by PIR and MSA Size (1993 American Housing Survey Children Times NHANES Phase 2 Prevalence ≥10 µg/dL)

	Year House Built:							
	Pre-1940		**1940-74**		**Post-74**		**Total**	
	Number	% of total	Number	% of total	Number	% of total	Number	% of total
Children with PIR ≤ 1.3	324	(36%)	256	(28%)	82	(9%)	662	(73%)
Children with PIR > 1.3	88	(10%)	138	(15%)	13	(2%)	239	(27%)
Total (all PIR)	412	(46%)	394	(43%)	95	(11%)	**901**	
Children in MSA < 1 million	150	(15%)	147	(15%)	142	(14%)	439	(44%)
Children in MSA > 1 million	245	(25%)	287	(29%)	22	(2%)	554	(56%)
Total (all MSA)	395	(40%)	434	(44%)	164	(16%)	**993**	
With PIR ≤ 1.3, MSA pop < 1 million	109	(12%)	70	(8%)	86	(10%)	265	(30%)
With PIR ≤ 1.3, MSA pop > 1 million	213	(24%)	155	(17%)	15	(2%)	383	(43%)
With PIR > 1.3, MSA pop < 1 million	48	(5%)	70	(8%)	9	(1%)	127	(14%)
With PIR > 1.3, MSA pop > 1 million	39	(4%)	68	(8%)	5	(1%)	112	(13%)
Total (all MSA and PIR)	409	(45%)	363	(41%)	115	(14%)	**887**	

Sources: U.S. Bureau of the Census and U.S. Department of Housing and Urban Development, "American Housing Survey for the United States in 1993." And U.S., Third National Health and Nutrition Examination Survey—Phase 2, 1992-1994

Table 6. 1993 Number of Children (in thousands) Under Age 6 With Blood Lead Levels ≥15 µg/dL, by PIR and MSA Size (1993 American Housing Survey Children Times NHANES Phase 2 Prevalence ≥15 µg/dL)

	Year House Built:							
	Pre-1940		1940-74		Post-74		Total	
	Number	% of total	Number	% of total	Number	% of total	Number	% of total
Children with PIR ≤ 1.3	134	(57%)	42	(18%)	3	(1%)	179	(76%)
Children with PIR > 1.3	36	(15%)	6	(3%)	14	(6%)	56	(24%)
Total (all PIR)	170	(72%)	48	(21%)	17	(7%)	**235**	
Children in MSA < 1 Million	37	(14%)	30	(12%)	38	(14%)	105	(40%)
Children in MSA > 1 Million	117	(45%)	35	(13%)	6	(2%)	158	(60%)
Total (all MSA)	154	(59%)	65	(25%)	44	(16%)	**263**	
With PIR ≤ 1.3, MSA pop < 1M	14	(6%)	24	(10%)	0	(0%)	38	(16%)
With PIR ≤ 1.3, MSA pop > 1M	118	(51%)	19	(8%)	1	(1%)	138	(60%)
With PIR > 1.3, MSA pop < 1M	26	(11%)	0	(0%)	10	(4%)	36	(16%)
With PIR > 1.3, MSA pop > 1M	10	(4%)	6	(2%)	5	(2%)	21	(8%)
Total (all MSA and PIR)	168	(72%)	49	(21%)	16	(7%)	**233**	

Sources: U.S. Bureau of the Census and U.S. Department of Housing and Urban Development, "American Housing Survey for the United States in 1993." And U.S., Third National Health and Nutrition Examination Survey—Phase 2, 1992-1994

Table 7 shows the total number of children under 6 by year of home construction, PIR, and MSA size, based on 1997 American Housing Survey data, and Table 8 shows the percentage change in each household category (cell) between the 1993 and 1997 American Housing Survey data. The American Housing Survey data in Tables 4 and 7 indicate that the total number of children under 6 declined from 22.8 million in 1993 to 22.2 million in 1997 (the Census Bureau also projects virtually no growth in the number of children under 6 through about 2008). Two other trends over these four years would also reduce the number of lead poisoned children. First, the population of children under 6 with PIR less than 1.3 actually fell by about one million, while children with PIR greater than 1.3 grew by 0.4 million. Second, the decline in children with PIR below 1.3 was entirely in pre-73 housing, and disproportionately in pre-46 housing. The shift of low PIR children to newer housing appears to reflect two trends with the older housing stock. First, many older units in poor condition are demolished each year. Second, substantial rehabilitation and gentrification of older neighborhoods reduces the number of older units that serve low PIR families with young children.

Table 7. 1997 Number of Children (in millions) Under Age 6 by PIR and MSA

	Year House Built:		
	Pre-1940	**1940-1974**	**Post 1974**
Children with PIR ≤ 1.3	1.37	3.05	1.98
Children with PIR > 1.3	2.79	6.11	6.91
Total	*4.16*	*9.16*	*8.89*
Children in MSA population area < 1 Million	2.19	4.26	6.29
Children in MSA population area > 1 Million	1.97	4.90	2.60
Total	*4.16*	*9.16*	*8.89*
Children with PIR ≤ 1.3, MSA pop < 1M	.68	1.36	1.40
Children with PIR ≤ 1.3, MSA pop > 1M	.69	1.69	.62
Children with PIR > 1.3, MSA pop < 1M	1.51	2.90	4.89
Children with PIR > 1.3, MSA pop > 1M	1.28	3.21	1.98
Total	*4.16*	*9.16*	*8.89*

Source: U.S. Bureau of the Census and U.S. Department of Housing and Urban Development, "American Housing Survey for the United States in 1997."

Table 8. Percentage Change in Numbers of Children Under Age 6 from 1993 to 1997

	Year House Built:		
	Pre-1940	**1940-1974**	**Post-1974**
	% Change since 1993		
Children with PIR ≤ 1.3	-31%	-14%	+5%
Children with PIR > 1.3	+1%	-1%	+6%
Total (all PIR)	-12%	-6%	+6%
Children in MSA population area < 1 Million	-16%	-11%	+11%
Children in MSA population area > 1 Million	-8%	-1%	-4%
Total (all MSA)	-12%	-6%	+6%
Children with PIR ≤ 1.3, MSA pop < 1M	-33%	-26%	+5%
Children with PIR ≤ 1.3, MSA pop > 1M	-28%	-1%	+11%
Children with PIR > 1.3, MSA pop < 1M	-4%	-1%	+13%
Children with PIR > 1.3, MSA pop > 1M	+9%	-1%	-8%
Total (all MSA and PIR)	-12%	-6%	+6%

Sources: U.S. Bureau of the Census and U.S. Department of Housing and Urban Development, "American Housing Survey for the United States in 199," and "American Housing Survey for the United States in 1997."

The net effect of these trends on the estimated number of lead poisoned children in 1997 is shown in Tables 9 and 10. Each household category in Table 9 reflects the NHANES prevalence of children under 6 with blood lead levels above 10 µg/dL for that housing category in Table 1 multiplied by the total 1997 American Housing Survey number of children under 6 in that household category from Table 7. The calculations that reflect PIR yield estimates of about 775,000 children above 10 µg/dL in 1997 versus estimates of about 900,000 in 1993. Table 10 applies the same approach to combine NHANES data in Table 2 with American Housing Survey data in Table 7 to estimate the number of children under 6 with blood lead levels greater than 15 µg/dL in 1997. The calculations in Table 10 that reflect PIR yield estimates of about 190,000 children above 15 µg/dL in 1997 versus estimates of about 230,000 in 1993.

Table 9. 1997 Number of Children (in thousands) Under Age 6 With Blood Lead Levels ≥10 µg/dL, by PIR and MSA size (1997 American Housing Survey Children Times NHANES Phase 2 Prevalence ≥10 µg/dL)

	Year House Built:							
	Pre-1940		1940-74		Post-74		Total	
	Number	% of total	Number	% of total	Number	% of total	Number	% of total
Children with PIR ≤ 1.3	224	(29%)	221	(29%)	86	(11%)	531	(69%)
Children with PIR > 1.3	89	(12%)	136	(18%)	15	(2%)	241	(31%)
Total (all PIR)	*313*	*(41%)*	*357*	*(46%)*	*101*	*(13%)*	***771***	
Children in MSA < 1 Million	126	(13%)	131	(14%)	158	(17%)	415	(44%)
Children in MSA > 1 Million	227	(24%)	284	(30%)	21	(2%)	532	(56%)
Total (all MSA)	*353*	*(37%)*	*415*	*(44%)*	*179*	*(19%)*	***948***	
With PIR ≤ 1.3, MSA < 1M	72	(9%)	52	(7%)	91	(12%)	215	(28%)
With PIR ≤ 1.3, MSA > 1M	154	(20%)	154	(20%)	16	(2%)	323	(41%)
With PIR > 1.3, MSA < 1M	46	(6%)	69	(9%)	11	(1%)	126	(16%)
With PIR > 1.3, MSA > 1M	43	(6%)	67	(9%)	4	(1%)	114	(15%)
Total (all MSA and PIR)	*315*	*(40%)*	*342*	*(44%)*	*122*	*(16%)*	***779***	

Sources: U.S. Bureau of the Census and U.S. Department of Housing and Urban Development, "American Housing Survey for the United States in 1997." And Third National Health and Nutrition Examination Survey—Phase 2, 1991-1994

Table 10: 1997 Number of Children (in thousands) Under Age 6 With Blood Lead Levels ≥15 µg/dL, by PIR and MSA Size (1997 American Housing Survey Children Times NHANES Phase 2 Prevalence ≥15 µg/dL)

	Year House Built:							
	Pre-1940		1940-74		Post 74		Total	
	Number	% of total	Number	% of total	Number	% of total	Number	% of total
Children with PIR ≤ 1.3	93	(49%)	36	(19%)	2	(1%)	132	(70%)
Children with PIR > 1.3	35	(19%)	6	(3%)	15	(8%)	57	(30%)
Total (all PIR)	129	(68%)	42	(22%)	17	(9%)	**189**	
Children in MSA < 1 Million	31	(12%)	27	(11%)	42	(17%)	100	(40%)
Children in MSA > 1 Million	108	(43%)	34	(14%)	5	(2%)	148	(59%)
Total (all MSA)	140	(56%)	61	(24%)	48	(19%)	**249**	
With PIR ≤ 1.3, MSA < 1M	9	(5%)	18	(9%)	-	(0%)	27	(14%)
With PIR ≤ 1.3, MSA > 1M	85	(45%)	19	(10%)	1	(1%)	105	(55%)
With PIR > 1.3, MSA < 1M	25	(13%)	-	(0%)	11	(6%)	36	(19%)
With PIR > 1.3, MSA > 1M	11	(6%)	6	(3%)	4	(2%)	22	(12%)
Total (all MSA and PIR)	131	(69%)	43	(23%)	16	(8%)	**190**	

Sources: U.S. Bureau of the Census and U.S. Department of Housing and Urban Development, "American Housing Survey for the United States in 1997." And U.S., Third National Health and Nutrition Examination Survey—Phase 2, 1991-1994

Table 11 summarizes housing stock changes from 1993 through 1997 that are reflected in the declining estimated number of lead poisoned children. First, pre-46 units account for most housing demolition. Second, the average number of children per housing unit declined slightly. Third, the percentage of children with PIR below 1.3 declined sharply in pre-46 housing.

Table 11. Changes in Housing Stock Reflected in Estimated Change in Number of Lead Poisoned Children Under Age 6 from 1993 to 1997 (occupied units in millions)

Year of home construction	1993 Occupied Units	1997 Occupied Units	Percent Change per year	Children < 6 per 1993 unit	Children < 6 per 1997 unit	1993 percent of children < 6 with PIR < 1.3	1997 percent of children < 6 with PIR < 1.3
pre-40	19.9	19.4	-0.57%	0.24	0.21	42%	33%
1940-74	44.4	44.3	-0.07%	0.22	0.21	36%	33%
Post-74	30.4	35.8	4.07%	0.28	0.25	23%	22%

Sources: U.S. Bureau of the Census and U.S. Department of Housing and Urban Development, "American Housing Survey for the United States in 1993" and "American Housing Survey for the United States in 1997."

3. Using American Housing Survey, Residential Energy Consumption Survey, and National Lead Paint Survey Data to Project the Number of Housing Units With "High" and "Low" Risk of Lead Paint Hazards

The estimated number of lead poisoned children in 1997 derived in Section 2 does not account for housing rehabilitation between 1993 and 1997, which could further reduce the number of lead poisoned children in 1997. In the short run, remodeling and rehabilitation work without safe practices and adequate cleanup can increase the blood lead levels of resident children exposed to lead dust. In the long run, however, substantial rehabilitation will generally reduce lead paint hazards by removing housing components with lead paint. This may be especially true when lead paint is removed from friction and impact surfaces as a result of window and door replacement. In fact, the HUD Evaluation data show that the lead paint hazard intervention strategies selected most often by Grantees were window work and/or window replacement, paint stabilization, and cleanup.

Table 12 shows Residential Energy Consumption Survey and American Housing Survey data on the percent of units that have replaced all of their windows prior to 1990, and from 1990 through 1997. The 1993 Residential Energy Consumption Survey data asks respondents if they have replaced all of their windows in the last two years (1992-93), in the last three to four years (1990-91) or earlier (pre-1990). The 1995 and 1997 American Housing Survey data report the number of units that replaced windows and doors and the amount that each unit spent on this housing upgrade. Table 12 shows the percent of American Housing Survey units spending more than $2000 on window and door replacement in each two-year survey period, as a rough estimate of the percent of units replacing all of their windows. Since 1990, the American Housing Survey and Residential Energy Consumption Survey data show that about 1.6% per year of all pre-1970 units have replaced all of their windows.

Table 12. Residential Energy Consumption Survey and American Housing Survey data on Window Replacement

Age of Housing	1993 Residential Energy Consumption Survey: All Windows Replaced			American Housing Survey: > $2K		1990-1997 Average/Year
	Pre-90	1990-91	1992–93	1994–95	1996-97	
Pre-40	13.1%	3.7%	3.3%	2.5%	2.4%	1.5%
1940-49	11.0%	3.5%	3.8%	3.0%	2.6%	1.6%
1950-59	10.3%	4.1%	4.4%	3.4%	2.3%	1.8%
1960-69	4.7%	2.8%	3.6%	2.9%	2.9%	1.5%
1970-79	1.1%	1.4%	2.0%	2.1%	2.2%	1.0%

Although replacing all the windows in a housing unit is not equivalent to abating lead paint hazards, and certainly does not abate all lead paint in the unit, it may serve as a good indicator for substantial rehabilitation and for housing in good condition. The Cincinnati longitudinal study found that children living in deteriorated older housing had mean blood lead levels that were almost twice the mean blood lead of children living in rehabilitated housing and pre-WWII housing in satisfactory condition. Dust lead levels in deteriorated housing were also substantially higher than dust lead levels in rehabilitated housing and pre WWII housing in satisfactory condition. Housing condition was assessed as "satisfactory" if the house

appeared to be well maintained and had no peeling paint visible from the street. Deteriorated housing was lacking one of both of these features. Rehabilitated units were extensively rehabilitated about 10 to 20 years prior to this study, with interiors that were frequently gutted and exteriors that were often sandblasted or chemically cleaned. These three categories of housing in the Cincinnati study were all in the same general location, so the variation in blood lead and dust lead levels should be primarily attributable to the extent of lead paint hazards in each unit.

Replacing all of the windows in an older house demonstrates a level of housing reinvestment that probably results in a relatively low risk of future lead paint hazards, similar to the rehabilitated and satisfactory housing in the Cincinnati study. The extent of lead paint removal in units that replace all of their windows is not as great as in the extensively rehabilitated housing in Cincinnati, but window replacement does remove lead paint from an important friction and impact surface that could have contributed to future lead dust levels. Furthermore, the level of housing investment from window replacement is a strong indication that other upgrades and repairs will be made to the same housing unit over time. At a minimum, housing units where all of the windows have been replaced are also likely to satisfy the Cincinnati criteria Analysis for "satisfactory" condition.

Table 13 shows American Housing Survey data on window and siding replacements costing more than $2000, for owner-occupied units, by PIR. The units that reported window replacement costing more than $2000 in 1994-95 and in 1996-97 were not generally the same units that reported siding replacement costing more than $2000 during the same four year period, but the siding and window replacement data do show a similar pattern by PIR. Households with PIR above 1.3 are more likely to make either type of investment in their homes. It is reasonable to assume that units with all the windows replaced are also likely to have siding replaced over time, and to have other upgrade and upkeep investments made to maintain or enhance home value. Therefore, it is reasonable to use window replacement rates as a proxy for rehabilitation affecting lead paint hazards.

Table 13. Percent of Units With Window Versus Siding Replacement > $2K, by PIR (American Housing Survey 1994-97, Owner Occupied Units)

Window and Door Replacements	PIR<1.3	1.3<PIR<3.5	3.5>PIR
Pre-20	2.7%	4.5%	6.0%
1920-39	1.7%	4.7%	6.1%
1940-49	3.9%	4.6%	7.8%
Siding Additions and Replacements	**PIR<1.3**	**1.3<PIR<3.5**	**3.5>PIR**
Pre-20	0.9%	2.5%	4.1%
1920-39	0.4%	2.3%	2.6%
1940-49	0.5%	1.9%	2.7%

Although Table 13 reflects American Housing Survey data for owner-occupied units only, Residential Energy Consumption Survey data show that the percent of rental units that report all windows replaced in recent years is the same or slightly higher than the percent of owner occupied units that report all windows replaced. Furthermore, Table 14 shows that the tenure status of older housing units changed substantially between 1985 and 1997. About 37% of all pre-1940 housing units were rental units in 1989, but 55% were rental units during at least one of the 7 American Housing Surveys from 1985 through 1997, and only

about 23% were rental units throughout this period. Therefore, window and siding replacement rates for owner-occupied housing will be reflected in both owner-occupied and rental units over time.

Table 14. 1985-1997 Changes in Tenure Status (Across 7 American Housing Survey Samples)

	1989 American Housing Survey Percent Rented	Percent Ever Rented in 1985–97 American Housing Survey	Percent Always Rented in 1985–97 American Housing Survey
Pre-20	36%	54%	22%
1920-39	37%	55%	24%
1940-49	32%	50%	19%

Tables 15 and 16 combine data on demolition rates, window replacement rates, and HUD National Lead Paint Survey data on the percent of units without interior lead paint, to forecast the change in high-risk and low-risk units from 1989 through 1997. The second column of Table 15 shows HUD National Lead Paint Survey data on the percent of units without interior lead paint, by year built (post-74 units are assumed to have virtually no interior lead paint). The third and fourth columns show the number of occupied units, by year built, in 1989 and in 1997. The fifth column of Table 15 shows the annual percentage change in number of units, by year built, and the next two columns show how demolition rates might differ for low and high-risk pre-75 housing.

Table 15. Units With No Lead Paint, and Demolition and Rehab Rates, by Year Built

Year Built	No interior lead paint	Occupied Units (millions)		1989-97 Demolition rate per year			Window Replacement (Rehab) rate per year		
	1990	1989	1997	All	High Risk	Low Risk	All	High Risk	Low Risk
Pre-40	17%	20.82	19.44	0.86%	0.95%	0.40%	1.60%	1.85%	0.40%
1940-59	31%	20.90	19.80	0.68%	0.80%	0.40%	1.60%	1.85%	1.05%
1960-74	51%	25.49	24.49	0.50%	0.60%	0.40%	1.25%	1.50%	1.00%
Post-74	100%	26.48	35.76	NA	NA	NA	NA	NA	NA

Low-risk units in 1989 can be defined as units without interior lead paint. Lead paint was used so extensively prior to 1940 that it might be reasonable to assume that most pre-40 units without interior lead paint have already undergone substantial rehabilitation (removing interior lead paint). The percent of units with all windows replaced prior to 1990 (13.1% from Table 12) is very similar to the percent without interior lead paint in 1990 (17%), which also suggest that most pre-40 units without interior lead paint have had substantial rehabilitation. This suggests that low-risk units are less likely to be demolished because rehabilitated units are less likely to be demolished. Therefore, the annual demolition rate of .86% for pre-40 housing is assumed to reflect a weighted average of .95% for high-risk housing and 0.4% for low-risk housing (.83x.95 + .17x0.4 = .86).

HUD National Lead Paint Survey data show that 31% of 1940-59 units had no interior lead paint in 1990, and 51% of 1960-78 units had no interior lead paint. Within either housing category, older units are more likely to have interior lead paint and are also likely to be demolished at a higher rate than newer units without lead paint. Also, the percent of 1940-59 units with all windows replaced before 1990 (about 10.6%) suggests that many pre-60 units without lead paint may have undergone substantial rehabilitation. Therefore, the annual demolition rate of 0.68% for 1940-59 housing is assumed to reflect a weighted average of .80% for high-risk housing and 0.4% for low-risk housing (.69x.80 + .31x0.4 = 0.68). Similarly, the annual demolition rate of 0.50% for 1960-74 housing is assumed to reflect a weighted average of .60% for high-risk housing and 0.4% for low-risk housing (.49x.60 + .51x0.4 = 0.50).

The last three columns of Table 15 show the annual window replacement rate by year built, and how rates differ for low and high-risk pre-75 housing. Table 12 shows that about 1.6% of all pre-70 units replace all of their windows each year, but only about one percent of units built in the 1970s replace all their windows each year. Most pre-40 units and many 1940-59 units without lead paint in 1990 are likely to have undergone rehabilitation (window replacement) prior to 1990, and it is unlikely that these units would replace all of their windows again for many years. Therefore, the annual rehab rate of 1.6% for pre-40 housing is assumed to reflect a weighted average of 1.85% for high-risk housing and 0.40% for low-risk housing (.83x1.85 + .17x0.4 = 1.6). Also, the annual rehab rate of 1.6% for 1940-59 housing is assumed to reflect a weighted average of 1.85% for high-risk housing and 1.05% for low-risk housing (.69x1.85 + .31x1.05 = 1.6). The annual rehab rate of 1.25% for 1960-74 housing is assumed to reflect a weighted average of 1.5% for high-risk housing and 1.0% for low-risk housing (.49x1.5 + .51x1.0 = 1.6).

Table 16 shows how the data in Table 15 are used to forecast changes in the high and low-risk housing stock. The number of high-risk units in 1989 reflects the total number of occupied units in 1989 multiplied by the percent of units with interior lead paint, by year built. Pre-40 high-risk units are expected to decline by 2.8% per year (1.85% rehabilitated plus .95% demolished), 1940-59 high risk units decline by 2.65% per year (1.85% rehabilitated plus 0.8% demolished), and 1960-74 high risk units decline by 2.1% per year (1.5% rehabilitated and 0.6% demolished). Post-74 low-risk units increase by 3.73% per year with new construction. Low-risk pre-75 units experience a 0.4% demolition rate, but this decline is more than offset by the rehab rate for pre-75 high-risk units (rehabilitation of high-risk units moves these units to the low-risk category). Based on the assumptions detailed above, Table 16 shows the high-risk housing stock would decline from 44.2 million units in 1989 to 34.1 million units in 1999, while the low-risk housing stock would rise from 49.5 million units in 1989 to 67.1 million units in 1999.

The HUD National Lead Paint Survey indicated that lead in residential paint and associated lead dust hazards are both disproportionately concentrated in pre-60 units. Table 16 shows that 24 million high-risk pre-60 units remained in the housing stock in 1999 (13 million pre-40 units and 11 million 1940-59 units). The last column of Table 16 shows that 3.8 million of these high-risk pre-60 units will be rehabilitated by 2010 (2.1 million pre-40 units and 1.1 million 1940-59 units) and another 1.8 million units will be demolished (1.1 million pre-40 units and 0.7 million 1940-59 units). In the absence of Federal action, this would still leave 18.4 million high-risk pre-1960 units in 2010.

Table 16. Forecast Change in High and Low Risk Units Resulting from 1989-97 Demolition and Rehab (Window Replacement) Rates (housing units in millions)

Housing Type	1989 Units	Annual Rate of Change	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000-2010
High Risk Units													
pre-40	17.28	-2.80%	16.80	16.3	15.9	15.4	15.0	14.6	14.2	13.8	13.4	13.0	
1940-59	14.42	-2.65%	14.04	13.7	13.3	13.0	12.6	12.3	11.9	11.6	11.3	11.0	
1960-74	12.49	-2.10%	12.23	12.0	11.7	11.5	11.2	11.0	10.8	10.5	10.3	10.1	
Rehab													
pre-40		-1.85%	0.32	0.31	0.30	0.29	0.29	0.28	0.27	0.26	0.25	0.25	2.1
1940-59		-1.85%	0.27	0.26	0.25	0.25	0.24	0.23	0.23	0.22	0.22	0.21	1.7
1960-74		-1.50%	0.19	0.18	0.18	0.18	0.17	0.17	0.16	0.16	0.16	0.15	
Demolition													
pre-40		-0.95%	0.16	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.13	0.13	1.1
1940-59		-0.80%	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.7
1960-74		-0.60%	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	
Low Risk Units													
pre-40	3.54	-0.4%+HR rehab*	3.8	4.1	4.4	4.7	5.0	5.2	5.5	5.7	5.9	6.2	
1940-59	6.48	-0.4%+HR rehab*	6.7	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	
1960-74	13.00	-0.4%+HR rehab*	13.1	13.3	13.4	13.5	13.6	13.7	13.9	14.0	14.1	14.2	
Post-74	26.48	+3.73%	27.5	28.5	29.6	30.7	31.8	33.0	34.2	35.5	36.8	38.2	
High Risk Units	44.19		43.1	42.0	40.9	39.9	38.8	37.8	36.9	35.9	35.0	34.1	
Low Risk Units	49.50		51.2	52.9	54.5	56.3	58.0	59.8	61.5	63.4	65.2	67.1	
Percent High Risk	47.2%		45.7%	44.3%	42.8%	41.5%	40.1%	38.8%	37.5%	36.2%	34.9%	33.7%	
Change in High Risk %			-3.1%	-3.2%	-3.2%	-3.2%	-3.3%	-3.3%	-3.4%	-3.4%	-3.4%	-3.5%	

* High risk (HR) units that become low risk units due to rehabilitation (window replacement).

4. Calculating Lead Poisoning Prevalence for Children in High and Low Risk Housing

NHANES data can be combined with the data in Section 3 to estimate the lead poisoning prevalence for children in high versus low risk housing, by PIR and age of housing. As a first step, this analysis assumes that the lead poisoning prevalence in older low-risk units is approximately equal to the prevalence in post-1974 units. This assumption may understate the lead poisoning prevalence in older low-risk units because our definition of "low-risk" includes units with lead paint, and older units are more likely to be in older neighborhoods with dust and soil hazards created by deteriorating exterior lead paint from other buildings. Even in post-74 housing, however, the prevalence of lead poisoned children is much higher among households with a PIR below 1.3, suggesting that neighborhood lead paint risks may also be reflected to some extent in the post-74 prevalence data.

If we assume that the prevalence of lead poisoned children in low-risk older housing is approximately the same as the prevalence in post-74 housing, than we can estimate the prevalence of lead poisoned children in high-risk older housing based on the percent of older housing that is high risk. Table 16 shows the following distribution for older housing in 1994, at the end of NHANES III Phase 2:

- Pre-40: 75% high risk (15 million out of 20 million units)
- 1940-74: 53% high risk (24 million out of 45 million units)

These weighting factors can be used to estimate the following prevalence data:

- X1 = lead poisoning prevalence for children with PIR under 1.3 in low-risk housing = 4.33%
- X2 = lead poisoning prevalence for children with PIR above 1.3 in low-risk housing = 0.22%
- X3 = lead poisoning prevalence for children with PIR under 1.3 in high risk pre-40 housing
- X4 = lead poisoning prevalence for children with PIR above 1.3 in high risk pre-40 housing
- X5 = lead poisoning prevalence for children with PIR under 1.3 in high risk 1940-74 housing
- X6 = lead poisoning prevalence for children with PIR above 1.3 in high risk 1940-74 housing

The values for X1 (4.33%) and X2 (0.22%) are assumed to equal the NHANES III Phase 2 prevalence values for post-73 housing. The values for the other four categories can then be derived from the weighted-average NHANES prevalence values for pre-46 and 1946-73 housing, as follows:

- .25*4.33 + .75*X3 = 16.37
  X3 = (16.37 – (.25*4.33))/0.75 = 20.38%

- .25*.22 + .75*X4 = 3.19
  X4 = (3.19 – (.25*.22))/0.75 = 4.18%

- .47*4.33 + .53*X5 = 7.25
  X5 = (7.25 – (.47*4.33))/0.53 = 9.84%

- .47*.22 + .53*X6 = 2.24
  X6 = (2.24 – (.47*.22))/0.53 = 4.00%

These calculations indicate a lead poisoning prevalence of about 4% for children with PIR below 1.3 in low-risk housing (X1) and for children with PIR above 1.3 in high-risk housing (X4 and X6). The lead poisoning prevalence for children with PIR above 1.3 in low-risk housing is only 0.22%. The lead poisoning prevalence is much higher for children with PIR below 1.3 in high-risk housing: 20.38% for children in pre-40 housing and 9.84% for children in 1940-74 housing during the NHANES III Phase 2 sampling period (1992-1994).

5. Forecasting Lead Poisoning Prevalence by PIR and Age of Housing Based on Percentage of Housing Stock With High Risk of Lead Paint Hazards

The forecast decline in high risk units (Table 16) combined with the higher lead poisoning prevalence estimates for high risk units (derived in Section 4) indicates that the overall lead poisoning prevalence should decline with the decline in high risk units. Furthermore, data presented in this section suggest that lead poisoning prevalence estimates for children in low risk housing should also decline with the decline in the high-risk housing stock.

Table 17 shows the distribution of children (% of children<6) by PIR and age of housing, based on 1993 American Housing Survey data. Lead poisoning prevalence estimates are also shown for high and low risk housing, by PIR and age of housing category. Only 25.5% of children below a PIR of 1.3 lived in post-74 housing in 1993, whereas 42.2% of children above a PIR of 1.3 lived in post-74 housing.

Table 17. Distribution of Children<6 and Percent Above 10 µg/dL by PIR, Housing Unit Risk, and Year Built

Year Built	Percent of Children<6		High Risk Unit (% EBL)		Low Risk Unit (% EBL)	
	PIR<1.3	PIR >1.3	PIR<1.3	PIR >1.3	PIR<1.3	PIR >1.3
Pre-40	26.8%	17.8%	20.38%	4.19%	4.33%	0.22%
1940-59	21.9%	17.8%	9.84%	3.96%	4.33%	0.22%
1960-74	25.8%	22.2%	9.84%	3.96%	4.33%	0.22%
Post-74	25.5%	42.2%	NA	NA	4.33%	0.22%
All	100.0%	100.0%				

Table 18 provides additional detail on the distribution of children in post-74 housing, whether they moved into their post-74 unit during 1993, and whether other residential buildings within 300 feet are described in the 1993 American Housing Survey as “older” or “very mixed.” These data show that children below a PIR of 1.3 in post-74 housing are more likely to live in 1975-79 housing, more likely to have moved to this unit in 1993, and more likely to live near older residential buildings than are children with PIR above 1.3.

Table 18. Post-74 Units with Children<6, by PIR and Year Built With Percent Moved in 1993 and Percent Near Older Units

	Post-74 Units with Children<6	Percent of Row:	
		Moved in 1993	Near Older Units
PIR <1.3, 1975-79	40.6%	40.3%	21.0%
1980-84	26.6%	27.6%	19.3%
Post-84	32.8%	33.5%	38.7%
Post-74	100.0%	34.7%	26.6%
PIR >1.3, 1975-79	26.8%	29.4%	18.6%
80-84	21.6%	27.7%	20.3%
Post-84	51.6%	24.4%	23.1%
Post-74	100.0%	26.4%	21.3%

The data in Table 18 suggest that the higher lead poisoning prevalence for low PIR children in post-74 housing may be largely attributable to lead paint hazards in a previous residence and/or from nearby residences with exterior lead paint hazards. With respect to neighborhood lead paint hazards, 26.6% of low PIR children in post-74 housing and 38.7% of those in post-84 housing live near older buildings that could have deteriorating lead paint. Almost all of the post-74 units in the American Housing Survey that do not describe nearby buildings as "older" or "very mixed" describe the nearby buildings as "about the same" age as the American Housing Survey unit. About two thirds of low PIR children in post-74 housing are in 1975-84 housing units, where nearby buildings "about the same" age (based on a visual evaluation) could also include many pre-74 buildings with deteriorating lead paint.

The percent of low PIR children in Post-74 housing who moved in 1993, and the percent of low PIR children by age of housing, can be combined to estimate the extent to which the low PIR lead poisoning prevalence in Post-74 housing reflects lead paint hazards in a previous residence. The 1993 American Housing Survey was completed in October, so children who moved into the unit in 1993 could not have been there more than 10 months. To the extent that families with children are more likely to move during summer, those who moved in during 1993 had probably only been in their new home for a few months, on average. If we assume that the lead poisoning prevalence for these children reflects the lead poisoning prevalence for their previous housing category, then the lead poisoning prevalence for low PIR children in post-74 housing can be described as a weighted-average that incorporates the following values:

- 4.33% is the lead poisoning prevalence for children with PIR under 1.3 in Post-74 housing
- 16.37% is the lead poisoning prevalence for children with PIR under 1.3 in Pre-40 housing
- 7.25% is the lead poisoning prevalence for children with PIR under 1.3 in 1940-74 housing
- 34.7% of children with PIR below 1.3 in post-74 housing moved in 1993
- 26.8% of all children with PIR<1.3 live in Pre-40 housing
- 47.7% of all children with PIR<1.3 live in 1940-74 housing

If the low PIR children who moved to post-74 units in the past year reflect the distribution of all low PIR children by age of housing, then lead poisoning prevalence for low PIR children in post-74 units who haven't moved recently (Y) can be estimated as follows:

$$4.33\% = .347 * (.268*16.37\% + .477*7.25\%) + .653*Y = 2.72\% + .653*Y$$
$$Y = (4.33\% - 2.72\%)/0.653 = 2.47\%$$

This calculation indicates that almost half of the lead poisoning prevalence for low PIR children in post-74 housing may actually reflect their exposure to lead paint in previous residences built before 1974. The neighborhood lead paint hazards discussed above would explain some additional portion of the lead poisoning prevalence for low PIR children in post-74 housing. Finally, with 40.6 percent of low PIR children in post-74 housing living in 1974-79 housing, many of these children are also exposed to lead paint hazards in their own unit, because lead paint for residential use was not banned until 1978. For all of these reasons, it is reasonable to expect that the decline in high-risk units over time will also reduce the lead poisoning prevalence for low PIR children living in low-risk units.

6. Projecting the Number of Lead Poisoned Children in Low and High Risk Units, Before and After Adjustment for HUD Rule for Federally Assisted Housing

Table 19 shows how the projected decline in high-risk housing is likely to reduce the lead poisoning prevalence for children under age six in two ways. First, the projected decline in high-risk units will reduce the percent of children living in high-risk units. Second, the prevalence of lead poisoned children in low-risk units should also decline as the declining number of high-risk units reduces both the risk of neighborhood lead hazards and the percent of children poisoned in a previous residence. In particular, Table 19 assumes that the lead poisoning prevalence for each category of housing (derived in Section 4 for 1993) will decline each year at a rate equal to the rate of decline in the high-risk housing percentage of the total housing stock. Based on these assumptions, the number of lead poisoned children each year is calculated by multiplying the lead poisoning prevalence for each housing and PIR category by the number of housing units and the number of children per unit.

The decline in the number of lead poisoned children from 1993 to 1997 reflects both changes in the housing stock and changes in the percent of older units with poor children between 1993 and 1997, as discussed in Section 2. The projections beyond 1997 are all based on the 1997 American Housing Survey data on the average number of children per unit, and the percent of units with PIR below 1.3. The change in these two variables between 1993 and 1997 is why the number of lead poisoned children is estimated to have declined more rapidly between 1993 and 1997. Continued declines in the baseline number of lead poisoned children after 1997 reflect only the projected rate of demolition and housing rehabilitation (window replacement) which reduce the number of high-risk units.

The projection in Table 19 implicitly assumes that eliminating all high-risk housing would also eliminate all childhood lead poisoning. Of course, this assumption is not entirely realistic because lead paint hazards are not the only cause of lead poisoning. However, the analyses presented above suggests that eliminating lead paint hazards could very nearly eliminate childhood lead poisoning, or at least reduce the overall lead poisoning prevalence to the very low 0.22% prevalence already achieved for children in post-74 housing with PIR above 1.3.

Table 20 shows the number of low PIR children protected from lead poisoning by the HUD rule for Federally assisted housing. The lead poisoning prevalence estimates for this projection reflect a weighted-average of the prevalence for low and high risk housing, by age of construction. The number of units in 2000 reflects the number of units covered by the first year of the HUD rule, as reported in the Economic Analysis for the HUD rule for Federally Assisted Housing. The number of units in 2001 reflects the phase-in of additional public housing and project-based assistance units covered by the rule. The number of children protected is equal to the number of units in each category multiplied by the number of children per unit and the corresponding lead poisoning prevalence.

Table 19. Projected Number of High Risk Units and Associated Change in Lead Poisoning Prevalence

High Risk Housing Units			**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Percent High Risk			41.5%	40.1%	38.8%	37.5%	36.2%	34.9%	33.7%	32.5%
Change in High Risk Percent			-3.2%	-3.3%	-3.3%	-3.4%	-3.4%	-3.4%	-3.5%	-3.5%
Lead Poisoning Prevalence										
High Risk, PIR>1.3pre-40			4.19%	4.1%	3.9%	3.8%	3.7%	3.5%	3.4%	3.3%
High Risk, PIR>1.31940-74			3.96%	3.8%	3.7%	3.6%	3.5%	3.3%	3.2%	3.1%
Low Risk, PIR>1.3			0.22%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
High Risk, PIR<1.3pre-40			20.38%	19.7%	19.1%	18.4%	17.8%	17.2%	16.6%	16.0%
High Risk, PIR<1.31940-74			9.84%	9.5%	9.2%	8.9%	8.6%	8.3%	8.0%	7.7%
Low Risk, PIR<1.3			4.33%	4.2%	4.0%	3.9%	3.8%	3.6%	3.5%	3.4%
Pre-40, PIR<1.3			16.6%	15.8%	15.1%	14.4%	13.7%	13.0%	12.4%	11.8%
1940-74, PIR<1.3			7.3%	7.0%	6.7%	6.5%	6.2%	5.9%	5.7%	5.4%
Projected Number of children under 6 (in thousands) with blood lead levels above 10 μg/dl with PIR > 1.3										
Housing Category	**Children<6/unit**	**%PIR>1.3**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
High-Risk pre-40	0.214	67.0%	89	85	81	77	72	68	64	60
1940-59	0.216	66.0%	71	68	64	61	57	54	51	48
1960-74	0.199	67.3%	64	60	56	53	49	46	44	41
Low Risk pre-40	0.214	67.0%	1	1	2	2	2	2	2	2
1940-59	0.216	66.0%	2	2	2	2	2	2	2	2
1960-74	0.199	67.3%	4	4	4	4	4	3	3	3
Post-74	0.249	77.7%	14	14	14	13	13	13	13	13
Projected Number of children under 6 (in thousands) with blood lead levels above 10 μg/dl with PIR < 1.3										
High-Risk pre-40	0.214	33.0%	313	278	243	208	173	162	152	143
1940-59	0.216	34.0%	104	96	89	81	73	69	65	61
1960-74	0.199	32.7%	88	81	73	66	59	56	53	50
Low Risk pre-40	0.214	33.0%	20	19	18	17	15	15	15	15
1940-59	0.216	34.0%	26	25	24	24	23	22	22	22
1960-74	0.199	32.7%	45	43	40	37	34	33	32	31
Post-74	0.249	22.3%	82	80	78	76	74	75	75	75
All Children<6 with blood lead levels > 10 μg/dl			**925**	**857**	**788**	**720**	**651**	**621**	**593**	**565**

Table 20. Projected Number of Children with Avoided Lead Poisoning Due to HUD Rule for Assisted Units

EBL Prevalence				**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Pre-40, PIR<1.3				11.8%	11.2%	10.6%	10.1%	9.6%	9.1%	8.6%	8.2%	7.7%	7.3%	6.9%
1940-74, PIR<1.3				5.4%	5.2%	5.0%	4.8%	4.6%	4.4%	4.2%	4.0%	3.8%	3.6%	3.5%
Projected Number of children (in thousands) with avoided blood lead levels > 10 μg/dL due to HUD rule for Federally assisted units														
TBR	Units (thousands)		Children<6 per unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	2000	2001												
pre-40	80	80	1.76	16.5	15.7	14.9	14.2	13.5	12.8	12.1	11.5	10.9	10.3	9.7
1940-59	99	99	1.76	9.4	9.0	8.7	8.3	7.9	7.6	7.2	6.9	6.6	6.3	6.0
1960-74	163	163	1.76	15.6	15.0	14.3	13.7	13.1	12.5	12.0	11.4	10.9	10.4	9.9
Public Housing														
pre-40	16	33	0.70	1.4	2.6	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6
1940-59	66	131	0.70	2.5	4.8	4.6	4.4	4.2	4.0	3.8	3.7	3.5	3.3	3.2
1960-74	82	164	0.70	3.1	6.0	5.7	5.5	5.2	5.0	4.8	4.6	4.4	4.2	4.0
Project-based														
pre-40	97	109	0.34	3.9	4.1	3.9	3.7	3.5	3.4	3.2	3.0	2.9	2.7	2.6
1940-59	97	109	0.34	1.8	1.9	1.8	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3
1960-74	385	468	0.34	7.1	8.3	7.9	7.6	7.3	6.9	6.6	6.3	6.1	5.8	5.5
Other non-rehab														
pre-40	14	14	0.34	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3
1940-59	11	11	0.34	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
1960-74	27	27	0.34	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
Total Non-Rehab														
pre-40	207	236		22.3	23.0	21.8	20.7	19.7	18.7	17.7	16.8	15.9	15.0	14.2
1940-59	272	349		13.9	16.0	15.3	14.6	14.0	13.4	12.8	12.2	11.6	11.1	10.6
1960-74	657	822		26.4	29.7	28.4	27.2	26.0	24.9	23.8	22.7	21.7	20.7	19.8
Pre-75	**1,136**	**1,407**		**63**	**69**	**66**	**63**	**60**	**57**	**54**	**52**	**49**	**47**	**45**
Cumulative Non-Rehab				**63**	**131**	**197**	**259**	**319**	**376**	**430**	**482**	**531**	**578**	**623**

Rehabilitation covered by the HUD rule is not reflected in Table 20 to avoid any double counting of the overall reduction in high-risk units resulting from rehabilitation. The American Housing Survey and Residential Energy Consumption Survey data on window replacement used to project the decline in high-risk units should include Federally assisted rehabilitation. The Economic Analysis for the HUD rule shows that about 40% of assisted rehabilitation units report window and door replacement as part of their rehabilitation work in the 1995 American Housing Survey, and other assisted units may have replaced windows in earlier years.

7. Adjusting Projections for Lead Poisoned Children to Reflect Impact of Expanded HUD Lead Hazard Control Grant Program

Table 21 shows the additional number of low PIR children protected from lead poisoning by an expanded HUD Lead Hazard Control Grant Program. The number of units addressed each year reflects a phase-in strategy that emphasizes pre-40 units first, and shifts to more 1940-59 units in later years. The estimated number of children protected reflects the average number of children per unit multiplied by the lead poisoning prevalence for low PIR children by age of housing. Table 21 assumes that the number of young children per unit is similar to the Tenant-Based Rental units subject to the HUD rule for Federally assisted housing. The HUD rule applies to Tenant-Based Rental units with children under age six, and American Housing Survey data indicate that about half of these units have children ages one or two. In the case of the expanded Lead Hazard Control Grant Program, the concentration of young children in these units assumes that public health officials can direct families with young children (and those expecting a child) to units that have undergone hazard reduction or passed the hazard screen. The combination of the HUD rule and this expanded HUD Lead Hazard Control Grant Program could eliminate low-PIR lead poisoned children in pre-60 housing, and virtually eliminate low-PIR lead poisoned children in pre-1974 housing, by 2010. The analysis in Section 5 also suggests that this action would also substantially eliminate low-PIR lead poisoned children in post-74 housing, by eliminating the risk from previous residences and reducing neighborhood risks.

The projections in Table 21 assume that households with PIR less than 1.3 will realize all the benefits from the expanded Lead Hazard Control Grant Program. The eligibility criteria for the HUD Lead Hazard Control Grant Program are actually stated in terms of households with income between 50% and 80% of area income. Table 22 shows American Housing Survey data indicating that households with PIR below 1.3 will almost always meet the HUD criteria, and 56.6% to 81.8% of households that meet the HUD criteria will also have PIR below 1.3.

Table 22. Comparison of Low PIR and Percent of Area Income (X%) Criteria for HUD Lead Hazard Control Grant Program

	X=80%	X=70%	X=60%	X=50%
PIR< 1.3 & income < X% of area median	28.9%	28.8%	28.6%	26.9%
Only PIR < 1.3	0.3%	0.4%	0.7%	2.3%
Only income < X% of area median	22.2%	17.2%	11.5%	6.0%
Neither	48.6%	53.6%	59.2%	64.8%
Total	100%	100%	100%	100%
PIR < 1.3 as Percent of Less than X%	56.6%	62.6%	71.3%	81.8%

Table 21. Projected Number of Lead Poisoned Children under Six (in thousands) Before and After HUD Rule and Expanded HUD Lead Hazard Control Grant Program

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Baseline Projection for Lead Poisoned Children with PIR<1.3 (thousands)											
Pre-40	158	149	141	133	125	118	111	104	98	92	87
1940-59	83	79	75	71	67	64	61	57	54	52	49
1960-74	81	77	74	70	67	64	61	58	55	52	50
Pre-1975	322	305	289	274	259	245	232	220	208	196	185
Children Protected by HUD Rule (Non-Rehab) (thousands)											
Pre-40	22	23	22	21	20	19	18	17	16	15	14
1940-59	14	16	15	15	14	13	13	12	12	11	11
1960-74	26	30	28	27	26	25	24	23	22	21	20
Pre-1975	63	69	66	63	60	57	54	52	49	47	45
Additional Children Protected by Expanded HUD Lead Hazard Control Grant Program Units (thousands)											
Pre-40		80	100	120	130	130	120	120	120	120	120
Pre-40 Cumulative		80	180	300	430	560	680	800	920	1,040	1,160
1940-59		20	50	80	120	120	130	140	150	160	170
1940-59 Cumulative		20	70	150	270	390	520	660	810	970	1,140
Avoided Number of Lead Poisoned Children Due to HUD Lead Hazard Control Grant Program (thousands)											
Pre-40	0	9	19	30	41	51	59	65	71	76	80
1940-59	0	1	3	7	12	17	22	26	31	35	40
Pre-60	0	10	23	37	53	68	80	92	102	111	120
Summary Projection for Lead Poisoned Children with PIR<1.3 (thousands)											
Baseline Projection	322	305	289	274	259	245	232	220	208	196	185
After HUD Rule	259	237	224	211	200	188	178	168	158	149	141
After Expanded Grant Program	259	227	201	174	146	121	98	76	56	38	21
Pre-60 Baseline Projection	241	228	215	203	192	181	171	162	152	144	135
After HUD Rule	205	189	178	168	159	149	141	133	125	118	111
After Expanded Grant Program	205	179	156	131	105	82	61	41	23	6	0

The expanded Lead Hazard Control Grant Program units in Table 21 are all pre-60 units because data from the HUD National Lead Paint Survey and the US Geological Survey both indicate that lead in residential paint is disproportionately concentrated in pre-60 units. The Economic Analysis of the HUD rule also found that health benefits of lead dust removal in 1960-78 housing are only about 60% of the benefits for lead dust removal in pre-60 units (because pre-60 units are more likely to exceed the dust hazard standard by a substantial amount).

Table 23 shows HUD National Lead Paint Survey data on the total surface area with lead paint, the average lead concentration in lead paint, and total tons of lead in paint by age of housing. These data indicate that post-60 housing accounts for only 9% of all lead in interior paint, and only about 14% of all lead in exterior paint.

Table 23. HUD National Lead Paint Survey Data on Surface Area with Lead Paint, Average Lead per Unit of Surface Area, and Percent of Lead by Year of Construction

	Pre-40	1940-1959	1960-1978	Total
Lead paint Surface Area (million sq. feet)				
Interior	15,912	8,247	5,279	29,438
Exterior	25,969	12,635	10,502	49,106
Average lead paint Concentration (mg/sq.c)				
Interior	5.7	2.5	2.0	
Exterior	6.1	4.2	3.2	
Total Lead in lead paint (1000 tons)	255	75	45	376
Interior	93	21	11	125
Exterior	162	54	34	251
Percent of Total Lead in lead paint	68%	20%	12%	100%
Interior	74%	17%	9%	100%
Exterior	65%	22%	14%	100%

Table 24 shows data on white lead consumption, by decade, from 1914-78 (US Geological Survey). White lead data for 1914-23 in Table 24 are used to estimate consumption from 1910 to 1920 because 1914 is the earliest year of available data. A small percentage of white lead was consumed in ceramics, greases, chemicals, plasterizers and stabilizers but the majority of white lead was used in paint. In fact, the paint industry accounted for about 95 percent of total white lead pigment consumption during the 1930s.

For comparison with white lead, Table 24 also shows consumption of red lead and litharge from 1920-78 (US Geological Survey). Litharge is primarily used in storage batteries. Red lead was used mostly for ceramics, lubricants, petroleum, rubber, glass, and other industrial applications, and was used very little in the paint industry as varnishes, enamels and glazes. The limited application of red lead by the paint industry was often as a rust-inhibiting primer coat for exterior metals, including bridges and automobiles, which were covered by a finish coat of different composition. The industrial uses of red lead are especially apparent in the data for the 1940s when there was a sharp increase in red lead and litharge consumption during World War II, while housing starts were sharply lower during the same period. The increase in red lead consumption in 1941 was specifically associated with efforts by the automobile industry to produce a record number of vehicles before converting to war production. Industrial lead consumption can result in paraoccupational lead exposure for young children (lead brought home from work exposure, usually on

work clothes) but white lead used in house paint would have the far more pervasive effect on children's blood lead levels. Therefore, the white lead data for each decade in Table 24 are used to estimate the amount of lead in residential paint in housing built before 1978.

Table 24. Estimated Average Paint Lead by Decade of Construction (housing units in millions)

	Lead Consumption (thousand tons)		Decade-End Occupied Units	White Lead pounds per Unit	1991 Housing Units	1991 White Lead (thousand tons)		Percent of All White Lead
	White Lead	Red Lead and Litharge				Before Rehab	After Rehab	
1914-23	1,340	0	24.35	110	9.02	496	413	49.1%
1920-29	1,307	356	29.91	87	5.06	221	184	21.9%
1930-39	737	421	34.86	42	5.98	126	104	12.4%
1940-49	476	1,189	42.83	22	7.67	84	72	8.6%
1950-59	196	816	53.02	7	12.51	44	37	4.5%
1960-69	82	781	63.45	3	14.52	22	20	2.4%
1970-79	29	625	80.39	1	21	11	10	1.2%
	4,111	4,187				1,004	841	100%

The white lead data for each decade in Table 24 are divided by total occupied units at the end of each decade (United States Census Bureau) to estimate the tons of lead consumed per occupied unit during each decade. The white lead per unit is then multiplied by the number of occupied units that remained in the housing stock in the 1991 American Housing Survey, before subtracting the paint lead removed by rehab. Finally, the lead tons remaining in each age of housing category is reduced by the percentage of units with all windows replaced prior to 1991, as an estimate of substantial rehabilitation.

The calculations in Table 24 yield an estimate 841,000 tons of lead in paint remaining in pre-80 housing in 1991. This estimate is higher than the estimate of 376,000 tons in Table 23 for three reasons. First, the data in Table 24 are adjusted for housing rehabilitation but not for all the paint lead removed from older units by decades of paint peeling and scraping. Second, the estimates in Table 24 assume that all paint lead is used in residential units, but commercial buildings actually account for some of the paint lead consumed. Finally, the data in Table 23 reflect only the surface area of paint above the one mg per square centimeter federal definition of lead paint, whereas some of the paint lead in Table 24 was used in paint with a lead concentration below this threshold. In spite of these differences in methodology, the overall distribution of paint lead in Table 24 confirms the HUD National Lead Paint Survey data showing that post-60 housing accounts for a very small percentage of total paint lead in housing. The data in Table 24 also suggest that pre-20 units may account for a surprisingly high percentage of paint lead in housing.

8. Estimating the Benefits and Net Benefits of an Expanded Lead Hazard Control Grant Program

Lead paint hazard control activities provide the greatest benefit to children who avoid lead poisoning, but these same activities also benefit other children by reducing the average blood lead for children below 10 μg/dL. The Economic Analysis for the HUD Lead Paint Regulation for Federally Assisted Housing

estimates the combined monetized health benefit per housing unit where lead hazards are reduced. This "unit benefit" includes the benefit to children who avoid lead poisoning, plus the benefit of lower blood lead levels for children below 10 μg/dL.

The Economic Analysis for the HUD rule showed that almost all of the monetized benefit of reducing lead paint hazards results from the present value of increased lifetime earnings associated with higher IQ levels due to avoided childhood lead exposure. Cognitive ability is reduced, on average, by about one-quarter IQ point for every one μg/dL increase in childhood blood lead. A reduction of one IQ point reduces lifetime earnings, on average, by about $9,600 at a 3 percent discount rate, and by about $2,200 at a 7 percent discount rate. Therefore, a one μg/dL increase in childhood blood lead reduces average lifetime earnings by about $2,400 at a 3 percent discount rate, and by about $550 at a 7 percent discount rate. The Economic Analysis for the HUD rule also cites research indicating the average avoided increase in blood lead due to hazard reduction activities, and the average number of children per housing unit, to estimate the average monetized benefit of lead hazard reduction per housing unit.

Table 25 shows the health and market benefits associated with the expanded HUD Lead Hazard Control Grant Program, assuming that lead paint hazards will be found in approximately one-third of all units inspected. Only units that are treated (units where lead paint hazards are found) incur the costs and realize the associated market benefits of lead hazard reduction. The Economic Analysis of the HUD rule shows that pre-40 units account for about 53 percent of all pre-60 units with lead paint, and 1940-59 units account for the other 47 percent. The Economic Analysis also shows that 44 percent of pre-40 units and 18 percent of the 1940-59 units have deteriorated lead paint. Therefore, about one-third (32 percent) of all pre-60 units are expected to have lead paint hazards (.44 * 53% + .18 * 47% = 32%).

The health benefit estimates in Table 25 also assume that the number of young children per unit is similar to the Tenant-Based Rental units subject to the HUD rule for Federally assisted housing. (The Economic Analysis for the HUD rule estimates that 75-80% of health benefits are realized by children ages one and two). Table 25 further assumes that one-third of the children in units inspected and/or treated by the HUD Lead Hazard Control Grant Program will realize the benefits of hazard reduction, because about one-third of the children living in these units would otherwise have lived in units with lead paint hazards. The Economic Analysis benefit estimates for interim controls assume 5 years of avoided paint chip ingestion (paint stabilization) and 5 years of avoided lead dust hazards. Abatement, by definition, protects against lead paint hazards for at least 20 years.

In addition to monetized health benefits, the Economic Analysis for the HUD rule shows that interim controls and lead hazard abatement also provide maintenance and rehabilitation market benefits. A large part of the cost of interim controls is paint stabilization, but more than 90 percent of this cost reflects the market value of paint repair, and less than 10 percent reflects the incremental cost of safe practices associated with lead hazards. In the case of abatement, the Economic Analysis estimates that about 80 percent of the total cost is offset by the market benefits of housing rehabilitation (including window replacement) and only 20 percent is an incremental cost of lead hazard reduction. Table 25 shows the following estimated market benefits for the expanded HUD Lead Hazard Control Grant Program:

- $1.058 billion for interim controls
- $15.64 billion for hazard abatement

Table 25. Monetized Health Benefits and Market Benefits (dollars in millions) of Expanded HUD Lead Hazard Control Grant Program

Monetized Health Benefits:	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Interim Control Benefits at 3%										
5-year avoided paint hazards	$27	$48	$60	$75	$75	$75	$78	$81	$84	$87
5-year avoided dust hazards	$370	$657	$822	$1,027	$1,027	$1,027	$1,068	$1,109	$1,150	$1,191
Total	$397	$705	$881	$1,102	$1,102	$1,102	$1,146	$1,190	$1,234	$1,278
Cumulative	$397	$1,102	$1,983	$3,085	$4,186	$5,288	$6,434	$7,624	$8,857	$10,135
Interim Control Benefits at 7%										
5-year avoided paint hazards	$8	$14	$17	$21	$21	$21	$22	$23	$24	$25
5-year avoided dust hazards	$85	$151	$189	$236	$236	$236	$246	$255	$265	$274
Total	$93	$165	$206	$258	$258	$258	$268	$278	$288	$299
Cumulative	$93	$258	$464	$721	$979	$1,236	$1,504	$1,782	$2,070	$2,369
Abatement Benefits at 3%										
20-year avoided paint hazards	$59	$104	$130	$163	$163	$163	$170	$176	$183	$189
20-year avoided dust hazards	$806	$1,433	$1,791	$2,239	$2,239	$2,239	$2,329	$2,418	$2,508	$2,597
Total	$865	$1,537	$1,922	$2,402	$2,402	$2,402	$2,498	$2,594	$2,690	$2,786
Cumulative	$865	$2,402	$4,324	$6,726	$9,128	$11,530	$14,028	$16,622	$19,312	$22,098
Abatement Benefits at 7%										
20-year avoided paint hazards	$17	$30	$37	$47	$47	$47	$48	$50	$52	$54
20-year avoided dust hazards	$185	$330	$412	$515	$515	$515	$536	$556	$577	$597
Total	$202	$359	$449	$562	$562	$562	$584	$607	$629	$651
Cumulative	$202	$562	$1,011	$1,572	$2,134	$2,696	$3,280	$3,886	$4,515	$5,167
Interim Control Market Benefits	**$41**	**$74**	$92	$115	$115	$115	$120	$124	$129	$133
Cumulative	$41	$115	$207	$322	$437	$552	$672	$796	$925	$1,058
Abatement Market Benefits	$612	$1,088	$1,360	$1,700	$1,700	$1,700	$1,768	$1,836	$1,904	$1,972
Cumulative	$612	$1,700	$3,060	$4,760	$6,460	$8,160	$9,928	$11,764	$13,668	$15,640

Table 26 summarizes the total costs, health benefits, market benefits, and net benefits over 10 years of the interim control and hazard abatement options for addressing lead paint hazards in pre-1960 housing occupied by low-income families not covered by the HUD rule. Abatement yields a higher net benefit based on a 3% discount rate for health benefits, but interim controls yield a higher net benefit based on a 7% discount rate for health benefits.

Table 26. Estimated Total Costs, Benefits, and Net Benefits of Options to Address Lead Paint in 2.3 Million Pre-1960 Housing Units Occupied by Low-Income Families Not Covered by HUD Rule, 2001-2010 ($ billion)

	Lead Hazard Screen and Interim Controls ($1000 per unit)	Inspection/Risk Assessment and Full Abatement of Lead paint ($9,000 per unit)
Cost	($2.3)	($20.7)
Health Benefit at 3%	$10.1	$22.1
Market Benefit	$1.1	$15.6
Net Benefit	**$8.9**	**$17.0**
Cost	($2.3)	($20.7)
Health Benefit at 7%	$2.4	$05.2
Market Benefit	$1.1	$15.6
Net Benefit	**$1.2**	**$00.1**

Source: Evaluation of the HUD Lead Hazard Control HUD Lead Hazard Control Grant Program; The Economic Analysis for the HUD Lead Paint Regulation for Federally Assisted Housing.